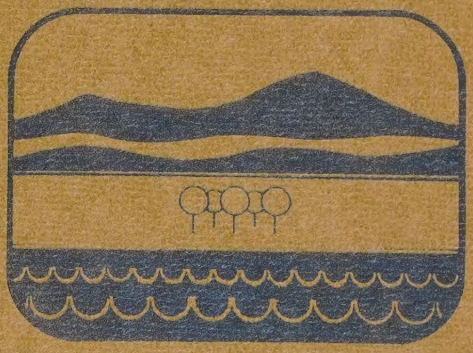
ENERGY ELEMENT



FAIRFIELD GENERAL PLAN

ENERGY: SAVE IT . . . OR LOSE IT.

AN ENERGY CONSERVATION ELEMENT FOR THE GENERAL PLAN OF THE CITY OF FAIRFIELD

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Adopted by Resolution No. 79-11 of the Fairfield Planning Commission on October 24, 1979

Adopted by Resolution No. 79-207 of the Fairfield City Council on December 4, 1979

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SUMMARY OF MAJOR FEATURES

In response to the problem of high-priced and dwindling energy supplies, the City of Fairfield has prepared this Energy Conservation Element for its General Plan. In order to develop energy policies applicable to local conditions and needs, the Energy Conservation Element begins with a brief analysis of Fairfield's energy situation and the need for conservation. To begin the conservation program, the Element recommends three major fields of action: citywide education, municipal management and administration, and community planning and development.

With a citywide education program, the City would become an "energy expert" to inform people about efficient energy management. These education efforts would be directed to City employees as well as to the community at large. Recommended actions in this regard include:

1) establishing official support for energy conservation by instituting a City employee education program and by retaining a consultant to prepare a more thorough study of the Fairfield "energy picture";

2) developing community support through citizen outreach and education programs and by providing assistance for home improvements that conserve energy.

In the area of municipal management, the City government would become a more efficient consumer by reducing the amount of energy used in municipal operations, thus setting an example to the public of conservation methods and ethics. Recommendations in this area include:

3) modifying existing City policies related to levels of lighting, procurement practices, and vehicle fleet management to reduce energy use;

4) promoting energy conservation in existing City buildings through energy use monitoring, more insulation, and more efficient heating and cooling systems;

5) emphasizing energy efficiency when designing new municipal buildings, with attention to the structure's shape, orientation, landscaping, and use of waste heat;

With new community and development practices, the City can influence the way Fairfield grows and develops so that, in the future, it will use less energy and use it more efficiently. Recommended actions in this area include:

6) promoting energy conservation in residential construction by developing building standards which emphasize the "energy performance" of residences;

7) encouraging energy-conscious land use planning through such tactics as increased densities, more regard for the natural environmental conditions, and reduced dependence on the automobile;

8) making better use of the environmental impact report process in energy planning.

The Element concludes with a brief list of beginning steps that the City could take to assure that its energy program gets underway. These initial actions can be undertaken now, without major changes to existing municipal regulations and without high costs. In this regard, the Element recommends that Fairfield appoint an energy coordinator from within the City government to manage the conservation program; institute life-cycle costing in all procurement decisions to obtain energy savings in the long run; prepare an energy audit of municipal facilities to see where energy is being wasted; and organize a citizens' advisory committee or task force to help implement the energy conservation program.

INTRODUCTION

THE ENERGY CRISIS

The nature of the United States energy crisis is quite simple: the demand for energy is growing, while the traditional sources, primarily oil and natural gas, are diminishing in amount and increasing in cost.[1] The rise in energy use has occurred in all sectors -- residential, commercial, industrial, and governmental -- and has resulted not only from economic and population growth, but also from the increase in high energy-consuming life-styles, capital goods, and methods of production. Until recently, oil and gas were cheap, abundant, and readily available, and there was no incentive to limit the amount of consumption. Even when the United States was not able to produce enough of its own energy to meet domestic demand, it could turn to foreign supplies.[2] Apart from considerations of political and economic vulnerability, the United States cannot rely indefinitely on foreign imports to cover its domestic deficit, because world oil and gas resources are limited too and will be demanded increasingly by other countries as well. Alternative sources of energy -- nuclear, solar, geothermal -- are very costly, may have undesirable social and environmental consequences, and are not yet fully developed for large-scale use. So, in the short run, the American people must adjust their energy consumption patterns to reduce pressures on domestic resources and to limit imports.

ENERGY CONSERVATION--PART OF THE SOLUTION

Many people are convinced that there is no energy crisis, but rather a conspiracy of ruthless Arabs, greedy corporations, and ineffectual government. Others believe that our technological expertise will shortly develop unlimited new sources of clean, affordable fuels. Few people are aware that conservation can also become a relatively inexpensive, alternative "source" of energy, in the sense that energy which was previously wasted can be productively used to meet needs elsewhere in the economy.

Energy conservation does not mean doing without but doing better with what we have. The question to ask is not "How much do we have?" but rather "How well are we using it?" Saving a unit of energy through better efficiency costs less than producing the same energy by developing new supply sources. Not only does energy efficiency save money, but it can reduce consumption with minimum social, environmental, and economic impact. A reduced rate of energy consumption provides time for clean, renewable sources to be developed and for new technologies to be applied. Most importantly, it would allow enough time for public attitudes and life-styles to change as education instills a greater understanding of the issues. This type of slow transition in attitudes is key to a successful switch to alternative energy sources and effective energy management.

Many energy-conserving actions must be initiated by individuals, either in their own personal lives or as part of their working and business activities. These changing patterns of behavior will occur in response to steadily increasing prices, uncertainties of supply, and a growing awareness of the problems associated with rapid growth of energy use. Nevertheless, effective government policies are needed to help make the necessary transition to an energy-efficient society happen sooner and with far lower costs in terms of economics, environmental harm and human suffering.

THE GOVERNMENT RESPONSE

The federal government and California's state government have been particularly active in identifying feasible means to reduce wasteful and unnecessary energy consumption. President Carter's National Energy Plan is devoted to both energy efficiency and the development of existing and future resources. The basic thrusts behind the conservation features of the plan include: establishing energy efficiency standards for automobile fuels, household appliances, and new construction; offering financial incentives for such energy-conserving activities as home weatherization and installation of solar systems; and reforming the utility rate structure so conservation rather than bulk use is more economical.

California has been especially involved in the enactment of energy conservation legislation, programs, and standards. In 1975, the state's environmental quality act was amended to require that environmental impact reports include a discussion of mitigation measures to reduce inefficient energy use.[3] In addition, the state's Energy Resources Conservation and Development Commission has prepared energy-conservant design standards for all new residential and commercial construction as well as minimum efficiency standards for major household appliances.[4]

However, the most promising arena for government action is at the level of the municipality. Not only can local planning and regulation be more finely "tuned" to particular conditions (e.g., variations in weather or type and cost of energy sources), but they are more likely to increase community interest and involvement. California's cities and counties, recognizing that energy is a factor which affects a variety of issues, including transportation, land use patterns, building design, and air quality, have emerged as pioneers in the field of energy management.

The range of local efforts in California has been very diverse. Some governments are simply gathering more detailed information on current consumption patterns in order to gear municipal programs to local problems and opportunities (Contra Costa and San Diego Counties). Others are helping promote the use of alternative resources by protecting solar rights and offering financial assistance for the installation of solar systems (City of Santa Clara). Certain municipalities -- the City of Davis is the most noted example -- have moved more aggressively toward controlling energy use by enacting ordinances which alter building codes and subdivision regulations to require energy efficiency in new construction and development.

Although these and other local governments have only recently entered the field of energy planning, their efforts have already proved fruitful. The City of Davis estimates that, through the application of its construction standards, energy consumption in new residential buildings can be reduced by 50%.[5]

NEED FOR LOCAL ACTION IN FAIRFIELD

During the past several years, the City of Fairfield's consumption of energy, in particular of electricity, has grown at an average annual rate of 10% a year. In 1976, the city used about 67 million more kilowatt-hours of electricity than it did in 1971 (Figure 1). In contrast, the consumption of natural gas has remained at a fairly constant level, increasing by less than 2% per year, probably in reflection of its relative cost and availability. (See Appendix B, Tables 1 and 2 for a detailed breakdown of the city's use of electricity and natural gas between 1971 and 1976). Some of this growth can be accounted for simply by the city's own expansion: between 1970 and 1975, its population increased by over 6000 people, or almost 30%, while two large industries, Anheuser Busch and the Ball Can Company, began operations in 1976.[6]

However, per capita energy consumption has also increased in Fairfield during this same period. According to PG&E, the city's per customer, monthly consumption of electricity expanded at an average annual rate of 3% (includes residential, commercial, and industrial customers). This means that the average customer used roughly 100 more kilowatt hours of electricity in one month in 1976 than in 1971. (See Appendix B, Tables 3 and 4 for more data on the city's per customer monthly use).

Thus, the problem is not just that the city is using more energy because it's getting bigger, but that individual consumers -- be they single individuals, families, businesses, or government agencies -- are using more energy to meet their daily needs.

Residential use is an important factor in the City's increasing consumption of energy. In 1975, over 50% of the City's total energy usage occurred in the residential sector, as opposed to less than 30% for both Solano County and California. In addition, the average monthly consumption of both natural gas and electricity is greater for Fairfield's residential customer than for either the county's or the state's. (See Appendix B, Table 5). The most important factors in residential energy use are space heating and cooling and water heating (Figure 2).

This steady growth in local residential energy use has been accompanied by an equally steady increase in energy prices. For the average customer, this has meant larger utility bills every year. PG&E's figures indicate that, between 1971 and 1977, the annual utility bill for the typical Northern California customer more than doubled: from about $220 to almost $450 a year.[7]

No projections exist concerning future energy demand in either the City of Fairfield or Solano County, because forecasts on this small a scale are not considered reliable by either PG&E or the Energy Commission. The projections which have been prepared for Northern California by these two organizations tend to differ markedly: the utility expects growth in energy consumption to continue at the same rate it has in the past, while the commission hopes that it will not. (See Appendix B, Table 6 for a comparison of estimated electrical sales and peak demand forecasts by PG&E and the Energy Commission.)

However, even if this growth is kept to a minimum, all users will still have to deal with rising energy prices. The Energy Commission estimates that, over the next decade, the price of electricity will increase by 40% over the rate of inflation. For the typical residential customer, this means that 1985's annual electrical bill will be almost two and one-half times larger than 1975's.[8]

CURRENT CONSERVATION EFFORTS IN FAIRFIELD

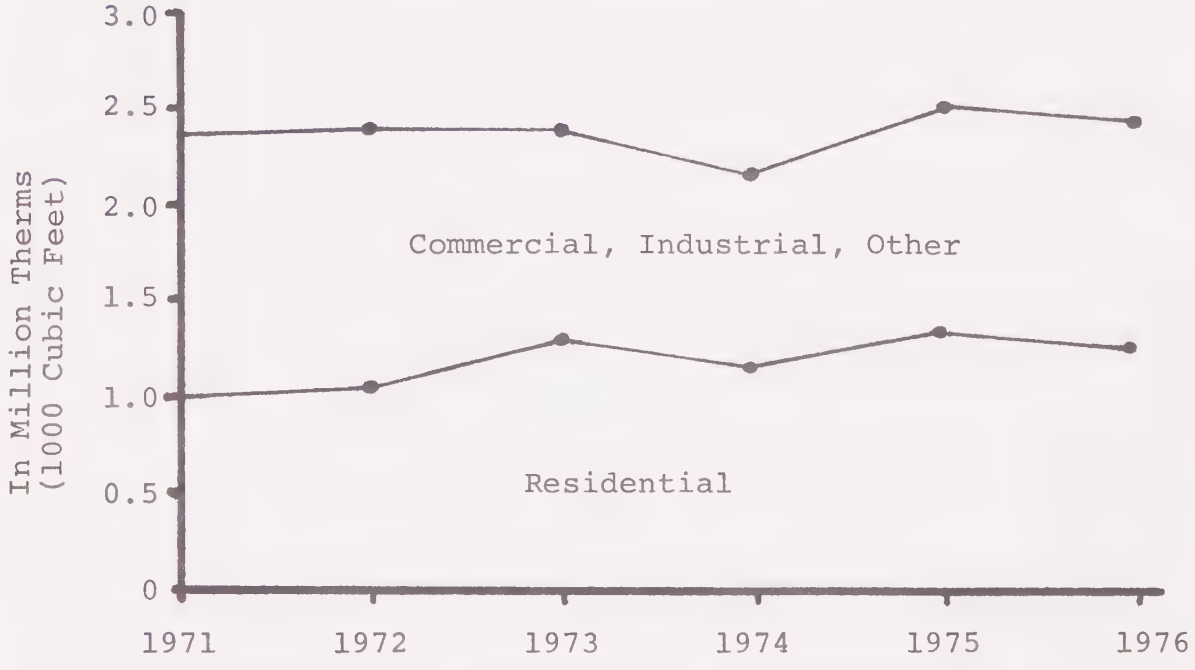
Although the Fairfield City government has no formal energy management program, it recently took the initiative to introduce some conservation measures in its own operations, and it has also begun to emphasize conservation in its transportation planning.

The City government has tried to limit energy consumption in its municipal operations in order to reduce its utility bills.[9] In 1976, the power bill for the Fairfield Civic Center amounted to $72,000; although the large bill was partly due to increased prices in electricity and natural gas, it was also apparent that the building's energy utilization could be made more efficient.

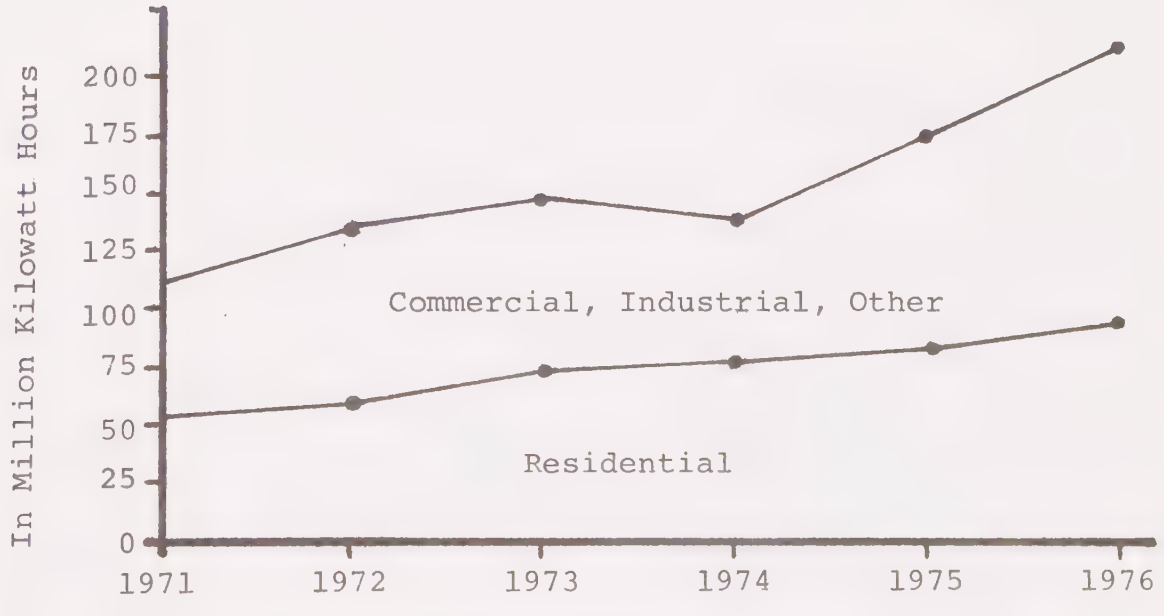
The Civic Center was wasteful of energy because the inside environment had to be maintained by running the heating and chilling units simultaneously, in both summer and winter, in order to assure a temperature balance throughout the building. However, when the monthly utility bill for February 1977 reached $2800, the City decided to turn off the chiller altogether and adjust the heater so temperatures were brought up more slowly and evenly throughout the building. This strategy proved to be successful since March's bill dropped to $400, as compared to $2200 the year before.

FIGURE 3: ENERGY USE

IN FAIRFIELD 1971-1976



Natural Gas Consumption by Class of Service



Electrical Consumption by Class of Service

SOURCE: Department of Environmental Affairs, Pacific Gas & Electric

In addition, the City has already established procedures of preventive maintenance for its major equipment to assure maximum operating efficiency. All heating, ventilating, and air conditioning systems are checked monthly by City personnel and checked on a quarterly basis by an outside company. Such a maintenance schedule could be achieving an estimated 10-15% energy savings.[10]

Finally, the City has begun to support the efficient use of energy in the transportation sector. It has prepared a bikeways and trails plan in order to encourage bicycling and walking and thus reduce dependence on the automobile. In the approval of the most recent residential developments, the City has required that all new subdivisions include off-street bicycle paths on arterial streets and on-street bicycle lanes on collector streets. In addition, the City instituted a public transportation system in 1975 in order to provide mobility for those residents who could not use the automobile. The City selected a demand-responsive system, known as DART. During the first two years of operation, the five DART vans carried nearly 185,000 passengers, and average daily ridership more than doubled.[11]

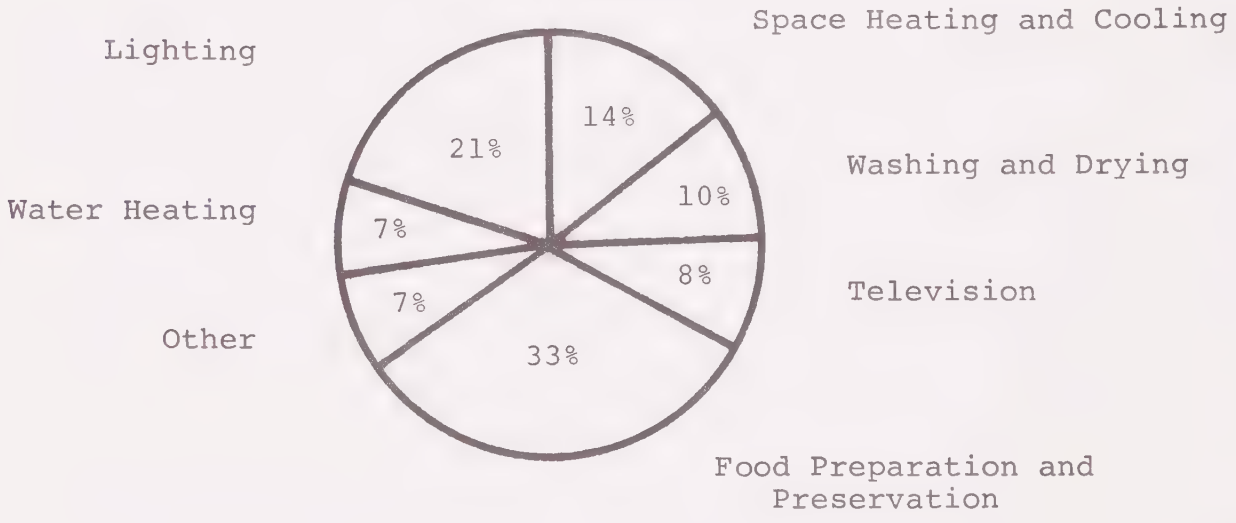
THE ENERGY CONSERVATION ELEMENT

While Fairfield has taken initial measures to promote energy conservation, it has done so without reference to a larger planning framework. These actions should not be considered a one-time effort, but simply the first part in a series of others directed toward overall energy management. To this end, the City has prepared the following "Energy Conservation Element" for its General Plan to develop energy policies that are applicable to local conditions.

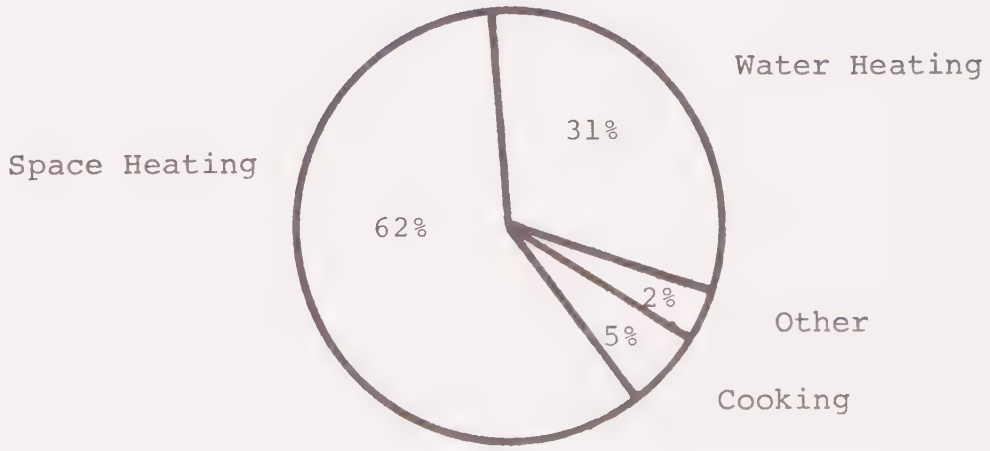
FIGURE 2

ESTIMATED DISTRIBUTION OF RESIDENTIAL GAS AND ELECTRICITY USE

ELECTRICITY



NATURAL GAS



SOURCES: Pacific Gas & Electric, The Outlook 1975.

A draft of the element was reviewed by the Fairfield General Plan Committee in January 1978, and the committee's comments were incorporated into the final, revised version of the element.

There are only certain aspects of the energy crisis which can be affected by the local Energy Conservation Element. Supply decisions are usually out of a city's hands, but the demand for energy is locally generated and thus locally controllable. If the city can control its demand for energy, then it can increase its flexibility and resiliency in dealing with a problem largely dictated by international and national policy. In Fairfield, there are three major steps leading to municipal energy management which can be taken by the City government through the implementation of this element. These include:

1) the City can educate the community -- its government officials, its residents, its businesses -- on what energy conservation means and how to go about it.

2) the City can make itself a more efficient consumer by reducing the energy it uses in municipal operations, thus setting an example to the public of conservation methods and ethics.

3) the City can manage the way it grows and develops so that, in the future, it will use less energy as a whole and use it more efficiently. Although this latter strategy shifts more responsibility for energy conservation onto the private individual or organization, in the long run it is also likely to make the most significant contribution toward resource management.

Although the problem of energy consumption and management is complex, there are many simple and specific steps that Fairfield can take to use its energy more efficiently. None of these actions require great technological breakthroughs or are very spectacular in themselves. None would require dramatic changes in personal life-styles or operational practices. None cost very much, and most would save both the City and its residents money. The energy savings resulting from the collective implementation of the recommendations in this program would be significant. Finally, when this report is examined carefully, what emerges is not a harsh and austere program, but rather a more efficient way of planning so that people going about their daily lives simply need less energy.

RELATIONSHIP TO GENERAL PLAN

A GENERAL PLAN COMPONENT

In essence the Energy Element for the City of Fairfield is only one of a number of individual components which constitute the Fairfield General Plan. In addition to the Energy Element these include the general plan elements for:

Housing
Land Use
Open Space and Conservation
Water Sewer Drainage
Scenic Roadways
Health and Safety
Transportation and Circulation
Recreation

Each element is designed to provide guidance in a certain area of the City's growth and development. Together the elements provide a comprehensive view of the goals, programs and policies that should be employed to shape Fairfield during the next twenty-one years. With the exception of this element the Recreation Element and Water-Sewer Drainage Element, each of the above elements is required by state law.

Further, the General Plan includes a specific plan for the new Cordelia area urban growth center. This plan entitled the Cordelia Area Specific Plan, is designed to provide special development regulations for the Cordelia area and taken together with the Land Use Element for the established Fairfield urban growth center, constitutes the land use program for lands in and proposed to be part of the City of Fairfield.

In addition to these components, the Plan includes a number of other special documents that should be referred to by the readers of this element.

GENERAL PLAN EIR/ENVIRONMENTAL ASSESSMENT

The General Plan incorporates the recommendations of an environmental impact report. The goals, objectives, and findings of the Plan are analyzed to assess the impacts they might have on the planning area environment and mitigation measures are recommended in the form of general plan policies that are to be implemented to alleviate adverse environmental impacts that can occur as the Plan is carried out. The potential impacts that result are summarized as a preface to the policies that pertain to energy conservation in this document.

The source for this information is the document called "The Fairfield General Plan EIR/Environmental Assessment" that has been developed to serve as a source of technical information concerning the General Plan and as an assessment of local environmental conditions.

THE GENERAL PLAN DIAGRAM

The General Plan Diagram is a graphic representation of the urban land uses both existing and proposed in the Fairfield General Plan. While the diagram is the instrument most often referred to by the public, it cannot be interpreted fully without reference to the remaining parts of the general plan, including the land use element. Only those proposals appear on the General Plan Diagram which lend themselves to graphic description.

A note should also be made concerning the timing of the development of the land uses shown on the diagram. All such uses proposed within the Urban Limit Line are illustrated, however, the full, total development, or build out of the urban land uses shown is projected to occur beyond the year 2000.

GENERAL PLAN FINDINGS

To provide summary information on the content of the General Plan, a document called "The Fairfield General Plan Findings and Conclusions" has been made available for general public distribution. This report includes the General Plan Diagram; General Plan goals and assumptions, implementing measures, major findings and conclusions of the Plan and the policies of each General Plan element.

THE GENERAL PLAN - A VEHICLE FOR LOCAL ACTION

Under California law, each city and county is required to prepare and adopt a comprehensive, long-term general plan which sets forth the objectives, principles and standards to guide its physical development.[12] Through the general planning process, a locality can establish a broader framework in which to carry out more immediate planning activities, such as permit approval. Several elements or chapters of each general plan are also required by law. These cover such areas as housing, circulation, land use, and open space. However, additional elements, "which in the judgment of the planning agency relate to the development of the county or city", are also permitted.[13]

Recently, problems of energy supply and greatly increased energy prices have introduced a major new concern into planning and policy-making. It has become clear that a city's development decisions can have a great impact on the future patterns and growth rates of its energy demand. Local governments are becoming aware that they are just as responsible for comprehensive energy planning as they are for directing land uses, housing, or recreation. Since the general plan is essentially a policy document for guiding development, it is an appropriate vehicle to direct local energy management programs.

An Energy Conservation Element can exist in direct relation to the other elements of the General Plan; however, certain elements, as noted below, are more directly responsive to energy planning than others.

Land use policies can shape a long-term physical form of development. It is this form which largely determines local energy use, and through energy-conscious land use planning, many of the underlying causes for our high energy usage can be changed. Certain types of land use configurations have been shown to lessen energy consumption more than others. In the local Land Use Element, specific policies which can result in reduced energy use include:

1) Concentrating the city's future development into growth centers, rather than permitting it to sprawl throughout the planning area. Compact development limits the energy needed for construction and delivery of services, the heating and cooling of buildings, and travel.

2) Permitting a broad range of density requirements, particularly for multiple developments. Certain studies have estimated that higher density, residential cluster development can result in a 44% energy savings by reducing the energy needed for construction as well as for heating and cooling.[14]

3) Consolidating retail areas to provide strong pedestrian linkages. Concentration encourages pedestrian travel and diminishes automobile use and fuel consumption. A recent study indicates that consolidating retail activity can reduce the fuel used for shopping trips by more than 40%.[15]

HOUSING ELEMENT

Energy usage in housing is linked to site location, density, size and orientation of the structures, method of construction, and the number and type of appliances installed. The Housing Element's emphasis on the Planned Development as the dominant approach to housing design could lead to significant reductions in energy use. Because the Planned Development approach permits greater flexibility in the application of subdivision regulations, energy conserving features can be more easily introduced into new residential development.

TRANSPORTATION ELEMENT

Transportation, particularly through the use of the automobile, consumes a great deal of energy, and Fairfield is especially dependent on this mode of travel. The Transportation Element can devote attention to developing alternatives which use less energy. Policies which could lead to reduced local fuel consumption include:

1) Improving the existing paratransit system so that residents other than the elderly, the poor, or the disabled will be inclined to use it.

2) Encouraging pedestrian travel through better design of streets and sidewalks.

3) Adopting a citywide Bikeway Plan, which can describe a safe, convenient bicycle transportation network throughout the community.

GOALS OF THE ENERGY ELEMENT

The first step in directing Fairfield's energy program is to set down the framework in which to shape policies and guide daily actions. Goals express general aims or purposes which are timeless in nature and are not readily measured. However, they are not meant to be utopian visions of what Fairfield's energy future should be like, but rather what it could be if the City and its residents work toward it.

GOAL 1: MAXIMIZE ENERGY CONSERVATION IN BALANCE WITH OTHER GOALS, SUCH AS ECONOMIC GROWTH, MAINTENANCE QUALITY, AND THE PROTECTION OF INDIVIDUAL LIFE-STYLES.

Energy is not just an issue of technology, but one which is imbedded throughout all aspects of society. There need not be any conflict between attaining energy conservation and social, economic, and environmental goals if they are planned as part of a common effort. In fact, energy conservation should complement these other goals, since many of today's social and economic problems result from inefficient and excessive energy use. Increased energy productivity, rather than increased production and consumption, can supply the same goods and services at a lower total cost. If the City and its residents emphasize making better use of their energy, rather than simply using less, then they need not do without the standard of living they currently enjoy.

GOAL 2: SEEK EQUITABLE SHARING OF BOTH HARDSHIPS AND BENEFITS OF CONSUMPTION AND CONSERVATION

On the local level, little has been done to address the "energy crisis" of lower income residents. In particular, there may be a tendency to forget the needs of such people when they comprise only a small percentage of the population, as they do in Fairfield.[16] However, lower income people are severely affected by the energy crisis: rising energy costs further reduce the limited income they have, and they are least able to afford improvements such as insulation which decrease energy use. Finally, policies designed to promote energy conservation in housing development could force land and housing costs to rise and limit housing choices for low income persons. The City should assure that, whatever energy conservation program is implemented, its lower income residents are neither excluded from its benefits nor made to bear an excessive share of its costs.

GOAL 3: COORDINATE LOCAL ENERGY PLANNING WITH NATIONAL, STATE AND COMMUNITY CONSERVATION POLICIES AND PROGRAMS

The scope of energy planning is so broad that local governments may have little impact unless they cooperate with one another and with higher levels of government, where regulatory power often rests and where financial resources are most abundant. The City should monitor new trends in energy planning and new state and federal energy legislation to find ways to strengthen its own energy conservation program. Also, the City's program will not be effective unless it relates to local planning for housing, recreation, economic development, and the like. An energy plan cannot be added, willy-nilly, to other City policies simply because energy is the crisis of the moment. The City can assure that its energy conservation program does not become a "one-shot deal" by integrating it with other plans for growth and development.

POLICIES FOR ENERGY CONSERVATION

Policies represent the alternative strategies by which the City of Fairfield can realize its goals. The energy conservation policies have been divided into three categories: education, municipal management and administration, and community planning and development. Each policy is accompanied by an action program which specifies what is to be accomplished and the subsequent steps needed for implementation. The following list of policies and action programs is by no means exhaustive, but does contain some effective tactics which the City can use to accomplish an energy management program that acts to mitigate some of the impacts listed below.

CITY AND COMMUNITY EDUCATION

Energy conservation can appear to be a complex matter. Information is abundant but scattered throughout a multitude of books and reports, which are available from an equally large number of organizations. Many individuals will lack the time and effort needed to learn about energy conservation practices. To meet this problem, the Fairfield city government could become an "energy expert" in order to teach people about efficient energy management. This education effort should be directed to its own employees as well as to the community at large. In addition, the City should coordinate with other agencies, such as PG&E, to include the supplies as well as the consumers of energy in the local education effort.

POTENTIAL IMPACTS

To emphasize the need for local energy conservation measures and policies the following major categories of impact that would occur as a result of General Plan implementation are noted: (Refer to General Plan EIR/Environmental Assessment)

1) By the year 2000, electricity consumption in the City would increase up to seven-fold, primarily as a result of industrial development.

2) Natural gas demand would increase about three-fold by the year 2000. However, it is questionable whether all of this demand could be met. Industrial users would probably rely heavily on fuel oil, creating air quality problems for the community.

3) The capital cost of providing new electrical generation capacity to support growth in the City, assuming nuclear power is used, would be $230 Million. The capital cost of providing new natural gas supplies to the City, assuming LNG is used, would be $50 Million. Total capital costs to PG&E for new energy supplies would be $280 Million.

4) Total annual energy costs in Fairfield for all forms of energy combined would probably be from 10 to 15 times their present level, measuring in constant dollars at about the year 2000.

POLICY 1: ESTABLISH A STRONG OFFICIAL COMMITMENT TO THE ENERGY CONSERVATION PROGRAM

The City should organize official support for the program and publicize its conservation efforts. Unless some person or group is responsible for the energy program, it will become just another idealistic plan. The City government cannot expect individuals to undertake energy management unless it is also engaged in the same endeavor.

ACTION PROGRAMS - POLICY 1

A. Appoint an energy coordinator or energy task force to manage the City's energy conservation program

If a coordinator is preferable, the person should be knowledgeable on energy matters and should be located in a municipal office that can affect energy planning, such as Environmental Affairs, Public Works, or the City Manager. If an energy task force is more desirable, its composition should reflect a balance among various interests in the community.

A typical committee might include staff members from: City government, the City Council and/or Planning Commission, PG&E, the Solano Irrigation District, the Fairfield/Suisun School District, business and industry, the building and real estate professions, and residential consumers.

The responsibilities of the coordinator or task force would include:

1) collecting local energy data and identifying wasteful consumption practices.
2) serving as an information center to the community.

3) promoting feasible, alternative energy sources.

4) serving as a liaison to other government agencies involved with energy as well as to PG&E and private developers.

5) monitoring and evaluating the energy conservation program.

B. Institute a government employee education program.

Without the support of its employees, the City government's "in-house" conservation programs have little chance of success. Education programs are needed not only to make City employees aware of energy waste and conservation techniques, but also to encourage new conservation ideas and suggestions. Also, employees are more likely to comply with the conservation program if they have been initially involved in its planning and development. In particular, the program should emphasize training City employees in such conservation-methods as energy auditing and life-cycle costing.

C. Retain a consultant to prepare a more detailed energy management study.

A consultant is suggested here because the City staff presently lacks the expertise needed to prepare such a study. However, a consultant could also be hired to train a City employee to become an energy specialist and perform such work.

Such a study might include:

1) a thorough analysis of the City's microclimate and the opportunities it presents for "passive" conservation measures.

2) data on the extent of need for residential retrofit, as well as the cost and savings of such programs, both in terms of energy and money.

3) a variety of ordinances designed to promote energy conservation in the private sector, such as heat loss/gain standards in new construction or guarantees of solar rights.

POLICY 2: ENLIST COMMUNITY SUPPORT TO ASSURE COMPLIANCE WITH THE ENERGY CONSERVATION PROGRAM

Regardless of the amount of official planning and backing for energy conservation, local programs are doomed to failure without citizen involvement. While government programs can encourage conservation through planning, regulation, and economic incentives, the success of the program depends on the commitment of individual citizens. The City should focus its initial efforts to gain community support in the residential sector, because data are more available here on consumption and on the potential benefits of residential conservation tactics.

In addition, residential energy use is a large and important factor in the City's "energy picture", and conservation programs in this area could be especially effective in reducing the City's total energy usage.

ACTION PROGRAMS - POLICY 2

A. Establish a community education and outreach program.

Individual commitment is not possible without an informed citizenry. One of the first responsibilities of the energy coordinator or task force could be to stir citizens' interest and seek community input in developing the energy program. Examples of what a community education program might contain include:

1) A citizens' guide or manual, with practical suggestions for reducing energy waste and with information on local, state and federal regulations and programs. In particular, the manual could provide information on residential retrofit techniques and their costs and benefits.

2) An energy conservation office to provide a central location for energy information, referrals, and technical assistance. Services could include preparing simple cost-benefit analyses of various conservation measures (such as installing additional insulation) or drawing up a list of local outlets for insulation and weatherstripping as well as of certified contractors.

3) Sponsoring energy conservation "spots" which feature both general information and specific techniques, in the local media.

4) Sponsoring classes and seminars on particular topics of interest to residents and businessmen, such as sources of funds for building retrofit, energy efficiency in appliances, and alternative energy systems suitable for local use.

5) Providing technical information and suggestions on energy conservation in the services <u>already</u> offered by existing City agencies, such as the Building Department. For example, when residents who want to undertake physical improvements in their homes come for a permit, building officials could point out ways to include conservation measures in the remodeling.

B. Prepare an energy audit for individual households.

An energy audit identifies energy use and waste patterns and then prescribes the necessary remedial measures. In the typical residential audit, a conservation technician makes an individual survey for the homeowner. The technician first determines how much energy is used for heating and cooling; this could show the consumer the potential for monetary and energy savings by simply setting thermostats lower in winter and higher in the summer. The next step is to analyze how and where energy is being wasted in the household. The technician then prescribes very specific retrofit measures to reduce energy consumption, for example, attic insulation, storm windows, a new fireplace damper, and the like. A comprehensive program would include periodic checks of future utility bills to evaluate the effectiveness of the retrofit measures.

An alternative would be for the City government to offer classes, perhaps in conjunction with PG&E or the State Energy Commission, training homeowners on how to prepare energy audits by themselves.

C. Provide assistance in financing retrofit improvements.

Identifying necessary retrofit measures serves little purpose without an active implementation and financing program. It is not likely that the City will have sufficient resources to establish a loan fund to finance retrofit improvements. A solution might be for the City to install insulation, for example, and then be repaid via additions to the water bill or by a special assessment to the tax bill.

However, the City government could help, through the previously mentioned education program, to lead people to other sources of financing. For example, the State now offers tax credits for the installation of insulation and solar systems. In mid 1978, PG&E began offering loans of up to $500 to residential customers to insulate their homes. The City could make people aware of these and other financing possibilities and help individuals determine which ones were most suitable for their specific needs.

D. Establish a weatherization program for lower income people.

Most lower income people can afford neither rising utility bills nor even simple retrofit measures, such as insulation. The City government should establish a "weatherization" program to help these residents make their homes less susceptible to heat losses and gains by adding attic insulation and sealing leaks around doors and windows. This program could be funded through municipal sources and/or through federal and state programs as they become available for such purposes. The City should consider incorporating a weatherization program into its housing conservation program, as Marin County is currently doing. Community development block grant funds can then be used for low interest loans or weatherization grants. Other possibilities include using part of the rehabilitation loans available under the California Housing Finance Agency's Neighborhood Preservation Program for weatherization.

In addition, a strong, local governmental conservation program demonstrates commitment to the national goal of husbanding scarce resources and thus provides an example for communitywide conservation efforts.

MUNICIPAL MANAGEMENT AND ADMINISTRATION

In this era of inflation and high municipal expenses, local governments are discovering that energy conservation makes good fiscal sense. Not only does an energy management program save money; but it also allows local government to maintain control over rising energy costs, so that funds promised for vital government services need not be robbed to pay the electric bill. In addition, a strong, local governmental conservation program demonstrates commitment to the national goal of husbanding scarce resources and thus provides an example for community-wide conservation efforts.

POLICY 3: MODIFY EXISTING ADMINISTRATIVE PRACTICES TO REFLECT A COMMITMENT TO ENERGY CONSERVATION

The most economical means of saving energy is simply to reduce consumption, and administrative actions in this direction are essential to achieve this goal. The City has already begun to cut energy use by altering heating and cooling systems in the Civic Center. However, there are several measures worthy of investigation which, if implemented could conserve significant amounts of energy:

ACTION PROGRAMS - POLICY 3

A. Reduce levels of lighting where not required for work or safety.

Many buildings in California are significantly over-lighted. This not only wastes energy but also generates additional heat in the building, thus increasing the need for air conditioning. The City should reduce overall illumination in government buildings and concentrate on "task lighting" to save energy. Task lighting means gearing illumination to the level required for the task involved. Hallways need relatively little light, for example, while work stations require much more. While lighting levels necessary for safety should always be maintained, lighting costs can be trimmed by:

1) removing certain fluorescent tubes in each lamp or replacing them with tubes of lower wattage.

2) using one large lamp rather than two smaller ones -- a 100-watt bulb is more efficient than two 50-watt bulbs, because it produces more light with the same amount of energy.

3) switching to more efficient (i.e. more light per watt) sources, such as fluorescent and mercury vapor lights.

4) putting automatic turnoff switches in lavatories, closets, and storage area so as not to rely on employees' memories.

B. Change governmental procurement practices to consider life-cycle as well as initial costs.

Traditionally, governmental purchasing decisions are based on the lowest initial cost and often ignore the costs of operating, maintaining, and replacing a product. A heating and ventilating system, for example, which costs more initially may be cheaper in the long run because its operating costs are lower. Life-cycle costing is a way to calculate the total cost of an item through its useful life. Purchase cost, repairs, and anticipated energy operating costs are all included in the final life-cycle cost. As energy prices rise, this method will produce a more realistic estimate of the true economic cost of a particular item. Life-cycle costing is the primary guide in the search for energy efficiency. In buying air conditioners, in analyzing building designs, and in choosing vehicles for a fleet, the goal is to find the product that is least expensive in the long run.

C. Gear vehicle fleet management practices toward energy efficiency.

The vehicles used by the City for police, administrative, and utility work can be chosen to conserve energy and save money. The City of Fairfield has already started to purchase smaller pickup trucks and to convert a number of its vehicles to propane gas, which costs less per gallon and burns more cleanly. Other opportunities for energy conservation include:

1) sensible operating and maintenance procedures to reduce fuel consumption, such as keeping track of gasoline usage; stressing good driving habits; instituting regular and frequent tune-ups; and eliminating unnecessary trips and/or combining trips.

2) carrying vehicles beyond normal retirement age through good maintenance and overhaul, since the latter is cheaper and more energy efficient than replacement. The City will save money if it doesn't need to purchase new vehicles so frequently, and it will save energy if its vehicles run properly.

3) changing vehicle specification practices, by switching to smaller cars, radial tires, and diesel or propane fuels. In particular, the City should consider purchasing "mini" cars (those that average over 30 mpg) for administrative trips.

POLICY 4: DEMONSTRATE CONSERVATION TECHNIQUES AND NEW ENERGY TECHNOLOGIES ON MUNICIPAL FACILITIES

The energy-inefficient buildings that exist today will be with the City in the future, when energy prices will be much higher. But, yesterday's construction practices do not necessarily commit Fairfield to yesterday's pattern of energy consumption. Significant energy savings are possible in existing buildings through modifications to insulation, ventilation systems, lighting, and wiring. According to a recent study, such changes could reduce energy use by almost 50% in schools and almost 60% in office buildings.[17]

ACTION PROGRAMS - POLICY 4

A. Prepare an energy audit on municipal buildings to provide data on consumption patterns and to identify areas of waste and possible savings.

The energy audit is an important first step in developing an energy management program for a building. The audit provides a data base which can be used to monitor energy consumption on a continual basis to assess the effects of various conservation measures.

In conjunction with the audit, the City should consult with PG&E to determine whether the utility could provide a functional breakdown of energy use for particular buildings. Knowing how much energy is used for lighting versus air conditioning or heating will help both to determine conservation priorities and to evaluate the results of the conservation program.

B. Take advantage of remodeling to install conservation devices such as additional insulation, more efficient heating and cooling systems, or even solar technology.

Since building retrofit can be expensive, such tactics should be considered only when substantial remodeling is planned. Of course, if energy prices rise dramatically or if supplies are curtailed, retrofit measures may become more cost-effective in the future.

As a practical and simple first step, the City might consider installing solar heaters for its public swimming pools. Heating swimming pools consumes a surprising quantity of natural gas; solar heating is far less expensive over the life of the pool. In most cases, a solar pool heater will pay for itself within five to seven years.[18] If natural gas supplies are curtailed in the future, solar energy may be the only alternative left for heating swimming pools.

POLICY 5: DESIGN NEW MUNICIPAL FACILITIES TO EMPHASIZE ENERGY CONSERVATION AND BEST USE OF ENVIRONMENT

When energy was cheap and plentiful, building design emphasized the management of interior environments through sophisticated climate-control systems. Energy-efficient design re-examines this approach and uses nature itself -- the sun, wind, shade, and earth -- to maintain interior comfort while conserving energy. A recent study indicated that proper design can achieve almost a 60% savings in energy use over conventional construction techniques.[19]

The City of Fairfield anticipates constructing a new vehicle maintenance building and a major addition to the police building within the next five years. It should work closely with the architects and engineers from the initial planning stages through final construction to assure energy efficiency. Hiring a firm which specializes in energy-conserving design may be desirable.

ACTION PROGRAMS - POLICY 5

A. The orientation and shape of new municipal buildings should be geared toward minimizing energy consumption.

Proper building orientation and shape can increase solar heat gain in the winter and decrease it in the summer. In addition, building siting can also permit use of natural ventilation to reduce the cooling load during summer months. It is critical for the city to explore this tactic because energy efficiency can be especially dependent on local climatic conditions.

B. Landscaping should be planned for energy conservation as well as for aesthetics.

Vegetation and trees can prevent the entry of the sun to keep a building cooler during the summer, just as they can diminish the impact of harsh winds in the winter. In particular, the City might wish to provide shading for its parking lots. Shading lots will reduce their temperatures by approximately $10^{o}F$; the lower air and surface temperatures will lessen the heat load on buildings, which in turn will lead to a 40-50% reduction in the energy used for air conditioning.[20] The City should select plants that require little water, so that landscaping to decrease energy consumption does not result in excessive water use.

C. Establish thermal efficiency standards for new municipal construction.

Although state energy conservation standards for non-residential buildings went into effect in July 1978, the City could consider developing its own code, tailored to local climatic conditions and energy costs. Thermal efficiency standards would specify how much heat per square foot could be lost in the winter and absorbed in the summer. A municipal construction code should deal with:

1) amount and type of wall and ceiling insulation.

2) limitations on amount of window area.

3) building heat storage capacity.

4) the use of lighting.

Sufficient insulation is possibly the most important conservation technique in new building design, because its specific purpose is to reduce heat flows. Capital investments in insulation are off-set by savings in energy costs.

D. Use waste heat.

Until recently, the heat generated by a building's lights, machinery, and people was ignored. However, rising energy prices are stimulating a great deal of interest in waste heat recovery systems. The heat is removed by exhausting room air through air-cooled fixtures in the ceiling. These systems have a two-fold benefit: waste heat can supplement expensive fuel-based heat and its removal eliminates a burden on the air conditioning system. Waste heat recovery systems are expensive, but pay for themselves quickly with energy savings.[21]

COMMUNITY PLANNING AND DEVELOPMENT

Because environmental conditions and energy costs vary greatly from place to place, a local focus on development control is needed for maximum energy and monetary savings. Fairfield can change its planning and building practices so that new development will be more energy-efficient, and that growth in energy consumption will be managed in accordance with available, local supplies and with the City's goals. The purpose of the following policies is to introduce energy conservation at the beginning of the development process, rather than add it on at the end.

POLICY 6: ESTABLISH BUILDING STANDARDS TO PROMOTE ENERGY CONSERVATION IN EXISTING AND FUTURE RESIDENTIAL DEVELOPMENT

Traditionally, building standards have been concerned with structural safety and health, and existing codes have not generally encouraged energy efficiency. The State has issued residential energy conservation standards, which went into effect in March 1978. However, local governments are given the option to "make such changes or modifications in the requirements. . . as it determines are reasonably necessary because of local conditions."[22] Since locally-adopted codes offer the greater potential for energy conservation, the City of Fairfield should not neglect this opportunity to institute sound energy planning.

ACTION PROGRAMS - POLICY 6

A. Amend the City's Building Code to require, in addition to the State energy standards, the use of other energy-conservant techniques in building design, orientation, and construction.

Although the State's energy standards will make an important contribution to improving housing, they do not cover certain factors critical to a building's "energy performance". The City could add other criteria to ensure that all new residential construction will be truly energy-efficient. These new standards should be made compatible with needs for safety and environmental health. Areas of future local regulation might include:

1) requiring light colors for exterior walls and roofs.

2) minimizing unshaded glass on east and west exposures through tinted glass, overhangs, or plantings.

3) prohibiting unnecessary decorative exterior lighting

4) requiring design which permits inside-outside circulation of air.

5) requiring design which increases use of natural lighting.

6) requiring certification of builder as to to the energy efficiency of the new home.

B. Enact an energy conservation ordinance which establishes minimum performance standards for structural heat loss and gain.

The basic purpose of this ordinance would be to reduce energy consumption by eliminating heavy use of air conditioners in the summer and minimizing heating in the winter. Such an ordinance could be passed in conjunction with the revisions to the Building Code. The code would prescribe the specific actions and criteria (such as those mentioned in the previous action program) to meet the minimum standards for heat loss and gain. If a builder desired more design flexibility, he would be allowed to deviate from the code by proving, through mathematical calculations, that the proposed building would not exceed the minimum performance standards.

C. Prepare a workbook for developers and builders to make compliance with the City's standards easier.

In addition to the code amendments or new ordinance, the City could also specify the exact techniques for effective compliance. A workbook could be written to include: examples of how new code provisions would work; suggested construction materials; and how to calculate heat loss and gain from standard building information.

Providing developers with methods to meet the new requirements would help mitigate their opposition to the changes and would assure more exact compliance.

D. Revise the Building Code to require retrofit of all residential dwellings on point of sale.

A variation on this theme would require the seller or purchaser of an uninsulated home to furnish as part of escrow, a contract and funds for insulation. Although such measures would ensure the eventual insulation of all homes, they are considered rather drastic and controversial. The City of Davis is currently investigating the practical feasibility, the legality, and the economic impacts of mandatory retrofit.

Fairfield should wait for the results of this study before proceeding with this action.

POLICY 7: INSTITUTE CONTROLS AND INCENTIVES TO ASSURE ENERGY-CONSCIOUS LAND USE PLANNING AND DEVELOPMENT

Proper land use planning will have as much to do with energy conservation as building performance standards. Currently, Fairfield's subdivision controls are based on considerations of topography, geography, and development type and density. The City should amend these controls to include energy conservation criteria to assure energy-efficient neighborhoods in the future.

It is important for Fairfield to incorporate energy considerations in its land development programs because the City in general and the Cordelia area in particular are anticipating much growth within the next 15 years.

The Cordelia area alone is projected to have a final population of between 32,000 and 40,000 people, representing in effect a "new town" within the City limits. Up to now, the Cordelia General Plan has stressed such goals as environmental quality, a good design image, and a strong economic base. The need for energy conservation also needs to be considered. The City might even plan to establish an energy consumption goal to assure that the community's growth and the ensuing demands on the energy system are compatible.

ACTION PROGRAMS - POLICY 7

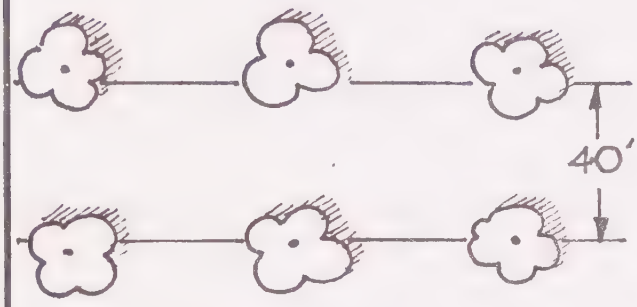
A. Make more efficient use of the land by increased development densities and innovative urban activity patterns.

Higher density housing developments consume less energy than the typical single family, detached home subdivision. Higher densities do not necessarily mean only multi-family residences; single family units are also possible, but clustered together more closely with common open spaces. The City should consider the following modifications to its zoning and subdivision regulations:

1) reduce minimum lot and building size. Smaller lots serve to lessen sprawl, limit the area covered with pavement, and decrease travel time, distance, and energy use. Smaller houses constructed according to energy-efficient design standards require less energy for heating and cooling.

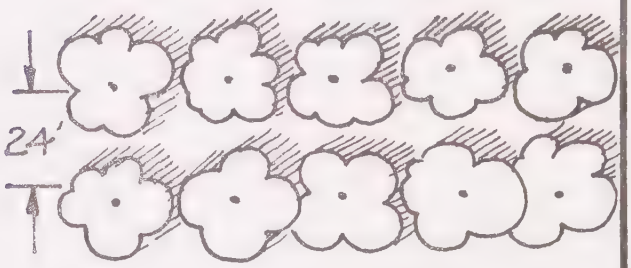
2) increase setback flexibility to allow clustering. Current setback regulations require large front, side and back yards; this creates a great deal of under-used and inefficient space and often prohibits common walls (zero lot lines).

FIGURE 3: USING STREET TREES



Typical Street

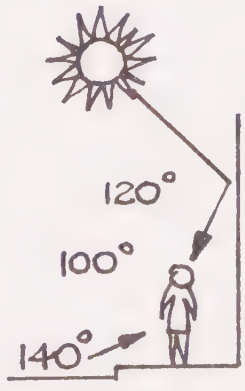
-Small trees far apart
-Wide pavement
-Little shade
-Very hot



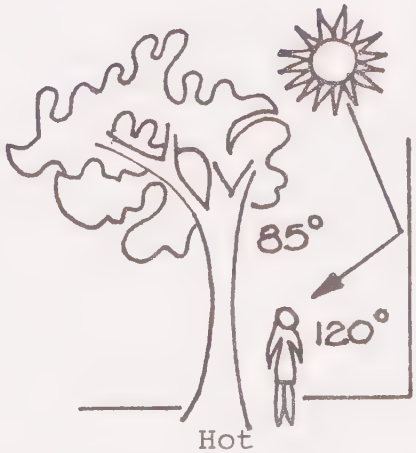
Proposed Street

-Large trees closely spaced
-Narrow pavement
-Full shade
-Comfortably cool

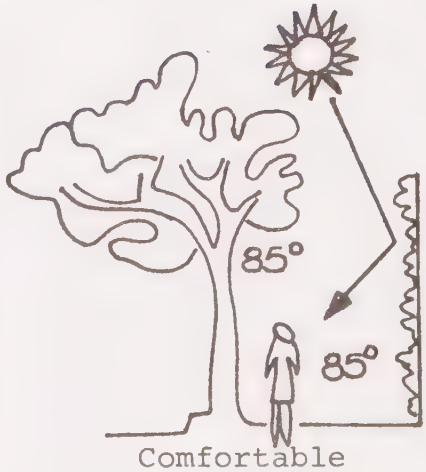
90° Base Temperature



Very Hot



Hot



Comfortable

SOURCE: Living Systems, 1977.

Attached buildings need less energy for heating and cooling since the potential for heat loss/gain is decreased. In addition, common wall developments can use centralized heating systems and other service facilities which are less costly and conserve energy. Setback requirements should be replaced only if safety and aesthetic standards are met.

3) reduce minimum street widths (Figure 3). The presently required street widths are designed to move automobiles quickly, but have adverse side effects on the microclimate and on subsequent energy use. The surface temperature of asphalt on a 90^{o} day can reach 140^{o}. This hot surface increases the surrounding air temperature by 10^{o} or more and thus amplifies the heat load on home air conditioners. This 10^{o} difference represents a 55% increase in energy used for cooling.[23] Narrower streets combined with shading can significantly reduce this increase.

B. Make more efficient use of the sun, wind, and other natural elements through passive design measures.

An area's climate should determine the proper design for buildings and communities. In most circumstances, appropriate design can reduce or even eliminate the use of purchased energy for heating and cooling. However, neighborhood planning standards often neglect the possibilities of energy-conscious layout and design. Fairfield should emphasize this aspect of energy planning since its climate is well-suited to this type of design. The summer's hot, dry weather is tempered by southeasterly winds coming through the Carquinez Strait and by cool nights. In winter, temperatures are not extreme, and the sun shines 50% of the time.[24] The City could take advantage of its moderate climate through the following changes to its zoning and subdivision regulations:

1) require that development sites be designed to permit favorable building orientation for natural heating and cooling (Figure 4). With traditional setback requirements, only lots on east/west streets have the proper southern exposure to receive the heat of the full winter sun.

   Proper orientation would be possible on north/south streets if front and rear setbacks were eased and the buildings were rotated to face south rather than the street. Developers should be required to plan the size, shape, and orientation of lots and buildings so that as many dwellings as possible can take advantage of energy-efficient siting.

2) require adequate landscaping for shade and climatic improvements (Figure 3). Existing subdivision regulations specify one tree per house lot, or every 75 feet; this will probably not result in effective shading. The City could require that trees be spaced at more frequent intervals (every 30 feet) to provide more protection from summer heat and thus limit the energy used for cooling.

   Landscaping criteria should also specify that trees cast dense to moderate shade; be long-lived and drought/disease resistant; and require little pruning. The City should ask developers to submit landscaping plans for subdivisions, to show future shading patterns and the potential for energy conservation.

3) protect solar rights. It makes little sense to orient new buildings to use solar energy if there is no way to prevent the solar system from being shaded by neighboring vegetation or structures. There are two ways for the City to protect access to the sun. It could simply require that evergreen trees and buildings stay within a basic height limitation; height restrictions are generally accepted under most zoning ordinances and have been upheld by the courts as a legitimate exercize of police power.

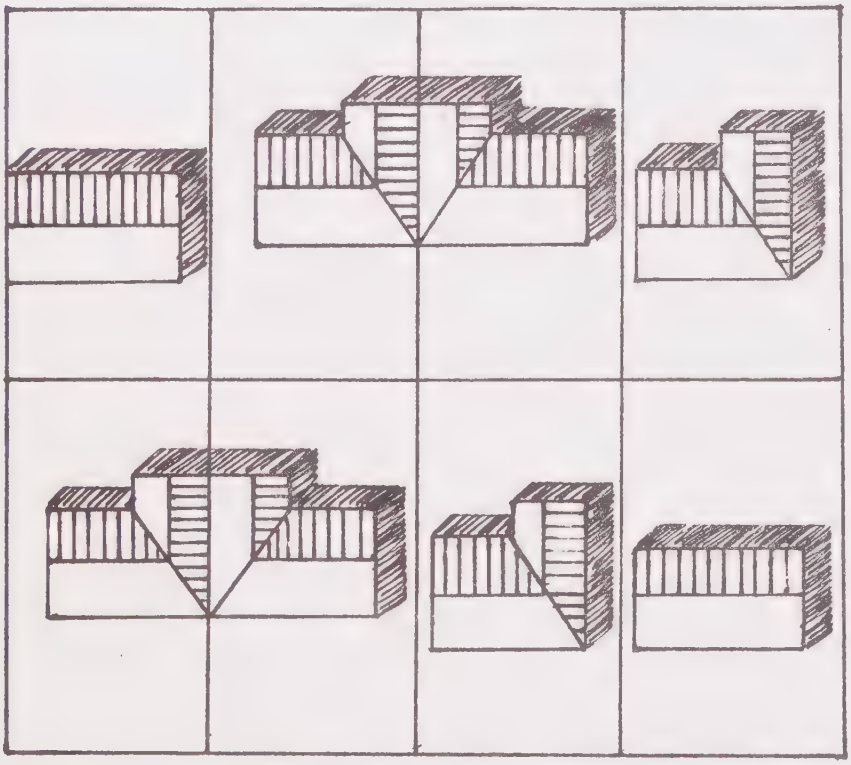
Or, the City could enact a comprehensive solar zoning ordinance, establishing reciprocal servitudes or easements which can be recorded and transferred as property rights. This second method requires legislation of a novel type and may face legal challenges.

D. Reduce dependence on the automobile.

In Fairfield, much emphasis has been placed on developing the automobile circulation system, thus encouraging a form of transportation that uses a great deal of energy and often very inefficiently. Even when alternative energy sources such as solar are in widespread use, they will not solve the shortage of liquid fuels. Although the car will not be supplanted by more efficient travel systems for a number of years, the City could try to promote bicycling, walking, and public transit alternatives in the following ways:

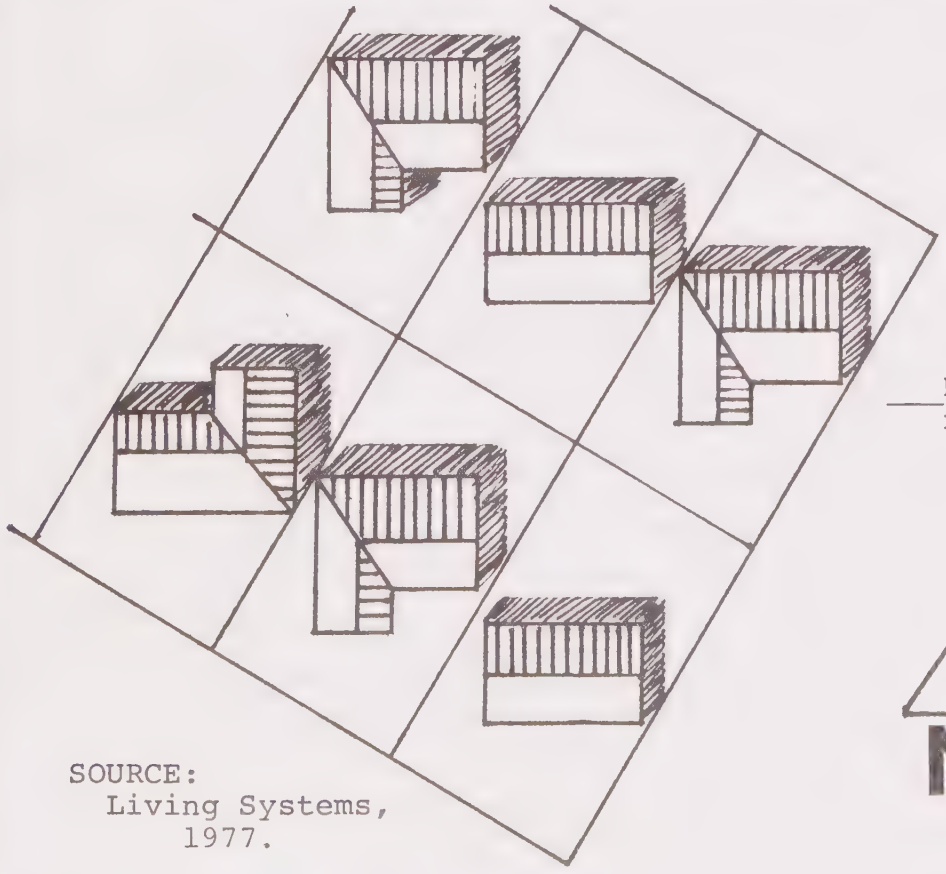
1) provide protected, convenient walkways and bicycle paths. These should be designed to be used for functional purposes such as travel to work as well as for recreation. Facilities such as benches, shaded rest areas, and bicycle racks should also be provided to encourage use of the paths.

FIGURE 4: SOLAR LOT ORIENTATION



Houses on east/west streets

Houses should have major yards to south to allow full exposure to the winter sun for solar heating



Houses on north/south streets

N

SOURCE:
Living Systems, 1977.

Multiply the maintenance and energy costs by the number of years of the product's lifetime and then add the initial cost. Finally, divide this total by the number of years and obtain the annual cost of a brand. Brand A's annual cost is $290; Brand B's is $230, and Brand C's is $195. Thus, Brand C is the cheapest in the long run, both because it costs less per year in maintenance and energy use and because it does not need to be replaced as often.

This example shows the basic principle of life-cycle costing. The City should require that vendors of equipment and other contractors provide this type of information in order to make decisions that save both energy and money.

PREPARE ENERGY AUDIT OF MUNICIPAL FACILITIES AND OPERATIONS

An energy audit can monitor the energy consumed in certain buildings or municipal operations and thus point out areas of energy waste. Once the City has identified unnecessary energy use, it can curb waste through administrative policies, such as lowering lighting levels in hallways. Such an audit would not only identify all areas of potential energy savings, but would also help assess the success of various conservation measures. Finally, through the audit, the City can establish and maintain an "energy quota" for each public building. Thus, the energy audit is a planning, management and control tool to be used not just once for immediate results, but also on a continuing basis to promote efficiency and lower costs.

The City should seek outside assistance to prepare the energy audit. Many of the major utilities will eventually offer this service within the next few years; but the City should make a special request of PG&E to see what is currently available.

At the very least, the City should be able to obtain energy use data on individual buildings. Another source of help might be the State Energy Commission. The Commission has assembled an energy audit team to visit state facilities and find ways to cut energy use. For example, the team's recommendations for the CAL-TRANS building saved $100,000 in annual energy bills.[25] Even though the audit cost $10,000, State officials were pleased with the result of their "investment." The Energy Commission's team will soon become available to cities and counties to provide on-site assistance, either by preparing the audit itself or by training local personnel to do it.

Last year, Fairfield spent over $500,000 for electricity and natural gas to operate public buildings and street lights and provide fuel for City vehicles. Even a 10% reduction in this energy consumption would represent a substantial ($50,000) savings for the City.

ORGANIZE A CITIZENS ENERGY ADVISORY COMMITTEE OR TASK FORCE

Energy issues may seem very remote to the average citizen -- more the concern of some large federal bureaucracy than a "home town" problem. The City should stimulate local interest in energy conservation planning and make people aware of how simple and yet effective local conservation efforts can be. To ensure public participation in the local energy program, the City could organize a citizens' advisory committee or task force. Advisory committees offer many benefits. Many people are committed to the success of the program; more ideas can be generated and heard; and those affected by the conservation program can participate in the initial planning.

Such a group would be especially helpful when the City begins to promote energy conservation throughout the community as well as in its own operations. For the energy committee to be useful, it should have specific responsibilities, and members should represent the varied interests of the entire community. Whatever form citizen outreach takes, the importance of efforts to develop local awareness and support should not be overlooked.

FOOTNOTES

1. From 1950 until 1973, when world oil prices quadrupled, the U.S. consumption of oil, the nation's major energy source, grew at an average annual rate of 4.4%; per capita energy consumption increased 50% during that same period. For more information on patterns and rates of growth in U.S. energy use, see The National Energy Plan, prepared by the Executive Office of the President, Division of Energy Policy and Planning (April 1977), pps. 1-17.

2. In 1976, approximately 42% of the oil consumed in the United States was derived from imports. See The National Energy Plan, pps. 11-16.

3. See Chapter 276, Statutes 1974, and Public Resources Code, Section 25404, 21151.

4. Health and Safety Code, Division, Part 3, Chapters 11 and 11.5; Public Resources Code, Section 25402(a).

5. Interview with Gloria MacGregor, Director of Community Development, City of Davis, July 22, 1977.

6. Fairfield Department of Environmental Affairs, Special Census: Selected Population and Housing Data (September 1975), p.1.

7. Telephone conversation with John Kenney, Conservation Division, Pacific Gas & Electric Company, August 22, 1977.

8. Telephone conversation wtih Ezra Amir, California Energy Resources Conservation and Development Commmission, August 22, 1977.

9. The following figures and information are the result of an interview with Joseph Shilts, Director of Pblic Works, City of Fairfield, July 18, 1977.

10. Federal Energy Administration, A Guide to Reducing . . . Energy Use, Budget Costs (Washington, D.C.: Government Printing Office, 1977), p. 62.

11. The Daily Republic (Upper Solano Conty, California), p. 1, August 9, 1977.

12. California Government Code, Title 7, Chapter 3, Local Planning.

13. Ibid., Section 65303(k)

14. Real Estate Research Corporation, The Costs of Sprawl (Washington, D.C.: Government Printing Office, 1974), p. 5.

15. Brookhaven National Laboratory, The Planner's Energy Workbook (Springfield, Virginia: National Technical Information Service, June 1977), Tables 33 and 37, pps. 86 and 90.

16. Acording to the City's Special Census (op. cit., p. 2), less than 13% of Fairfield's families earned less than $9,000 per year.

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APPENDIX A: GLOSSARY OF TERMS

Active vs. Passive energy conservation: active energy conservation relies upon equipment (such as a waste heat recovery system) to reduce energy use. Passive energy conservation relies upon design (such as south-facing windows) to minimize energy consumption.

Alternative energy sources: principally non-traditional, underused or developing, and renewable sources of energy such as solar, geothermal, wind, and nuclear fusion.

Energy audit: an inspection or survey of the energy consumed in a building to provide both a functional breakdown of energy use (e.g. how much energy goes for space heating vs. lighting) and to identify areas of waste and possible savings.

Heat gain: the amount of heat gained by a space from all sources, including sunshine, lights, people, machines, etc. The total heat gain represents the amount of heat that must be removed from a space to maintain desired indoor conditions.

Heat loss: the sum cooling effect on a building when the outdoor temperature is lower than the desired indoor temperature. It represents the amount of heat that must be provided to maintain indoor comfort.

Insulation: a material which separates a cool space from a warmer space and prevents the transfer of heat from one to another. In winter, insulation diminishes heat flow from the warmer house to the cooler outdoors; in summer, insulation reduces the flow from the warmer outdoors to the cooler interior.

Kilowatt-hour: the amount of energy used by ten 100-watt bulbs burning for one hour. An average home in Northern California uses approximately 6,500 kilowatt-hours of energy in one year.

Life-cycle costing: a method for determining the total cost of an item over its useful life. The initial cost, maintenance costs, and the energy costs are all included to arrive at the final life-cycle cost. With higher energy prices, this method will produce a more realistic estimation of the true economic cost of a particular item.

Retrofit: any technical design or structural adaptation to an existing building to promote energy conservation. Retrofit measures can include adding insulation to ceilings and walls, purchasing more energy-efficient appliances, or installing a solar heating system.

Task lighting: directing appropriate lighting levels to a specific task area. For example, lighting levels should be higher in areas where difficult visual tasks are performed, but lower in areas such as hallways.

Weatherization: a process by which leaks and cracks in a building are plugged; thus, cold air cannot infiltrate the structure and warm air cannot escape.

APPENDIX B:

TABULAR DATA ON FAIRFIELD'S ENERGY USE, 1971-1976

TABLE 1

CITY OF FAIRFIELD: ENERGY CONSUMPTION 1971-1976

	TOTAL	RESIDENTIAL	AS PERCENT OF TOTAL	COMMERCIAL/ INDUSTRIAL	AS PERCENT OF TOTAL
1971					
Electricity[1]	113,261,029	56,736,540	50.1%	54,706,575	48.3%
Gas[2]	2,429,378	1,115,678	45.9%	1,314,300	54.1%
1972					
Electricity[1]	131,070,758	63,970,882	48.8%	64,754,929	49.4%
Gas[2]	2,460,700	1,163,460	47.3%	1,297,240	52.7%
1973					
Electricity[1]	145,779,553	72,519,308	49.7%	70,435,017	48.3%
Gas[2]	2,464,958	1,190,574	48.3%	1,274,384	51.7%
1974					
Electricity[1]	143,029,573	75,139,037	52.5%	64,837,308	45.23
Gas[2]	2,243,328	1,157,246	51.6%	1,086,082	48.4%
1975					
Electricity[1]	152,737,755	80,004,695	52.4%	69,424,944	45.5%
Gas[2]	2,515,316	1,306,828	52.0%	1,208,488	48.0%
1976					
Electricity[1]	180,529,126	86,891,160	48.0%	90,082,456	50.0%
Gas[2]	2,434,110	1,256,033	51.6%	1,178,077	48.4%

1 - In kilowatt hours.
2 - In 1000 cubic feet.
3 - Figures do not add up to 100% because of miscellaneous uses.

SOURCE: Pacific Gas & Electric Company

TABLE 2

CITY OF FAIRFIELD: CHANGES IN ENERGY USE 1971-1976

	TOTAL USAGE	RESIDENTIAL	COMMERCIAL/INDUSTRIAL
1971-1972			
Electricity	+15.7%	+12.8%	+18.4%
Gas	+ 1.3%	+ 4.3%	- 1.3%
1972-1973			
Electricity	+11.2%	+13.4%	+8.8%
Gas	+ .2%	+ 2.3%	- 1.8%
1973-1974			
Electricity	- 1.9%	+ 3.6%	- 7.9%
Gas	- 9.0%	- 2.8%	-14.8%
1974-1975			
Electricity	+ 6.8%	+ 6.5%	+ 7.1%
Gas	+12.1%	+12.9%	+11.3%
1975-1976			
Electricity	+18.2%	+ 8.6%	+29.8%
Gas	- 3.2%	- 3.9%	- 2.5%
1971-1976			
Electricity	+59.0	+53.0%	+64.7%
Gas	+ .2%	+12.6%	-10.4%
Average Annual Change			
Electricity	+10.0%	+ 9.0%	+11.2%
Gas	+ 1.9%	+ 2.6%	- 1.8%

SOURCE: Pacific Gas & Electric Company
Department of Environmental Affairs of the City of Fairfield

TABLE 3

CITY OF FAIRFIELD: AVERAGE MONTHLY USE PER CUSTOMER 1971-1976

1971						
Electricity[1]	904.5	n/a	489.2	n/a	6,062.3	n/a
Gas[2]	20.6	n/a	10.0	n/a	208.6	n/a
1972						
Electricity[1]	962.3	+ 6.4%	509.5	+4.1%	6,274.7	+3.5%
Gas[2]	19.3	- 6.3%	9.6	-4.0%	190.7	-8.6%
1973						
Electricity[1]	1000.7	+ 4.0%	540.4	+6.1%	6,478.6	+3.2%
Gas[2]	18.1	- 6.2%	9.2	-4.2%	182.2	-4.5%
1974						
Electricity[1]	936.1	- 6.5%	533.1	-1.4%	5,784.9	-10.7%
Gas[2]	15.8	-12.7%	8.6	-6.5%	152.6	-16.2%
1975						
Electricity[1]	952.8	+ 1.8%	540.8	+1.4%	5,921.6	+2.4%
Gas[2]	16.8	+ 6.3%	9.2	+7.0%	164.0	+7.5%
1976						
Electricity[1]	1080.1	+13.4%	564.2	+4.3%	7,204.3	+21.7%
Gas[2]	15.6	- 7.1%	8.5	-7.6%	147.6	-10.0%

SOURCE: Pacific Gas & Electric Company
Department of Environmental Affairs of the City of Fairfield

1 - In kilowatt hours
2 - In 1000 cubic feet

Table 4

CITY OF FAIRFIELD: CHANGES IN AVERAGE MONTHLY USE PER CUSTOMER 1971-1976

TOTAL CHANGE 1971-1976	ALL SECTORS	RESIDENTIAL	COMMERICAL/ INDUSTRIAL
Electricity	+19.4%	+15.3%	+18.8%
Gas	-24.3%	-15.0%	-29.2%

AVERAGE ANNUAL CHANGE 1971-1976	ALL SECTORS	RESIDENTIAL	COMMERCIAL/ INDUSTRIAL
Electricity	+ 3.8%	+ 2.9%	+ 4.0%
Gas	- 5.2%	- 3.1%	- 6.4%

SOURCE: Pacific Gas & Electric Company
Department of Environmental Affairs of the City of Fairfield

TABLE 5

CALIFORNIA, SOLANO COUNTY, AND CITY OF FAIRFIELD: COMPARATIVE ENERGY USAGE 1975

AREA	TOTAL	AVERAGE MO. CUSTOMER	RESIDENTIAL USE	AS % OF TOTAL	AVERAGE MO. USE/ RES. CUSTOMER	COMMERCIAL/ INDUSTRIAL USE	AS % OF TOTAL	AVERAGE MO. USE/ COMMERCIAL CUSTOMER
CALIFORNIA								
Electricity[1]	146,337,228,096	1489.3	43,058,725,625	29.4%	503.2	103,278,502,471	70.6%	8136.6
Gas[2]	1,615,509,578	20.8	630,642,368	39.0%	8.6	984,867,210	61.0%	210.9
SOLANO COUNTY								
Electricity[1]	1,306,221,836	1636.4	369,126,551	28.3%	528.9	937,095,285	71.7%	9345.5
Gas[2]	22,001,026	32.8	5,561,621	25.3%	8.8	16,439,405	74.7%	62.0
FAIRFIELD								
Electricity[1]	152,737,755	952.8	80,004,695	52.4%	540.8	69,424,944	45.5%	5921.6
Gas[2]	2,515,316	16.8	1,306,828	52.0%	9.2	1,208,488	48.0%	164.0

[1]In Kilowatt hours.

[2]In 1000 cubic feet.

SOURCES: Pacific Gas & Electric Company
California Energy Resources Conservation and Development Commission

TABLE 6

ESTIMATED ELECTRICAL SALES AND PEAK DEMAND FORECAST 1975-1995

	P.G.&E. Estimate	Energy Commission Low Estimate	Energy Commission High Estimate
TOTAL SALES (million kilowatt hours)			
1975	60,262	60,258	60,258
1985	103,137	68,853	108,406
1995	156,537	72,970	177,384
Growth Rate 1975-1995	+4.9%	+1.0%	+ 5.6%
RESIDENTIAL SALES (million kilowatt hours)			
1975	20,062	20,058	20,058
1985	38,795	24,608	36,303
1995	64,563	26,249	56,550
Growth Rate 1975-1995	+ 6.1%	+ 1.4%	+ 5.3%
COMMERCIAL SALES (million kilowatt hours)			
1975	18,148	18,148	18,148
1985	30,635	19,650	35,255
1995	44,212	20,000	61,315
Growth Rate 1975-1995	+ 4.6%	+ .5%	+ 6.3%

	P.G.&E. Estimate	Energy Commission Commission Low Estimate Estimate	Energy High
INDUSTRIAL SALES (million kilowatt hours)			
1975	15,428	15,428	15,428
1985	25,961	16,850	29,103
1995	37,851	17,810	50,608
Growth Rate 1975-1995	+ 4.6%	+ .7%	+ 6.1%

SOURCES: Energy Resource Conservation and Development Commission Electricity Forecasting and Planning Report, January 1977.

APPENDIX C: LIST OF CONTACTS

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